

appearance immediately subsequent to the summer solstice and continues on the wing throughout July and August and occurs accordingly at the period of the greatest S.-W. Monsoon deluge, at sunny intervals during which specimens may be always seen on the wing. The second and fourth broods which appear respectively throughout May and June and September into October are about midway in size with regard to the expanse of their wings to the extremes represented by the first and fifth broods in comparison with the third or mid-summer form of the perfect insect. During my stay at Darjeeling I obtained a very fine series of this beautiful species, illustrative of all the different broods, which was much admired by my friend Dr. Alfred Russell Wallace when he came to see my collection of Himalayan Butterflies many years ago.

PLYMOUTH,

WILLIAM HARCOURT-BATH.

February 6, 1943.

XXI.—CONTROL OF *Aedes Egyptus* (*Stegomyia fasciata*) OR TIGER MOSQUITO (THE CARRIER OF YELLOW FEVER) IN THE BOMBAY HARBOUR BY A PATENT MOSQUITO-PROOF CAP AND TAP.

Brig.-General Covell, I.M.S., Director, Malaria Institute of India commenting on the discussion on his report on Malaria in Bombay remarked that Bombay was known as the worst Port for mosquitoes in the East as instanced by the repeated complaints made by Ships officers visiting the Port. He simultaneously urged for devising means to control the unlimited breeding of *Aedes egyptus*, the cause of this prevalence of mosquito in the country craft in the Harbour and Docks of Bombay. Since then much water has flown under the bridge. In 1935 soon after assuming the charge of Malaria Preventive Measures in the Port Trust Estates, Docks and Bunders as its Administrative Medical Officer, a preliminary survey of country craft made by me revealed that out of 898 country craft examined, 458 or more than half the number were found breeding *Stegomyia fasciata* giving a ratio of about 51% or that every alternate native craft was breeding the pest. This mosquito breeds profusely in one or more open fresh water receptacles or barrels which are round or oblong, square and box-shaped liberating thousands of adults. Most of these barrels are open or barely covered with a piece of cloth or plank, water being taken in Bombay or along other ports of call in all sorts of conditions. This water when examined revealed not only mosquitoes, but dirt and debris of all kinds including droppings of rats, cockroaches, fibre or coal particles and was drawn by hand for drinking with the risk of conveying diarrhoea, dysentery and cholera germs. As the Bombay Port Trust did not have compulsory powers for examination of the craft at the time, it was decided to continue to carry out the surveys further by examination and emptying out water when necessary by a notice freely circulated urging gentle persuasion and education of the tindal or master of the craft. Many refused at first the voluntary request, but with a full year of

working with constant examinations and emptying out, 19453 country craft or vessels were examined in 1935-36 showing a reduction in breeding of 28.7%, in 5688 of the craft so examined when 5551 were persuaded to empty out the infested waters. Fresh water was allowed free from the Docks and Bunders in its place. Progress was made in 1936-37 with the same voluntary working when with the repeated inspections and emptying out, breeding further diminished to 19.3% as seen from figures given below. Improvement continued during the next year to 14.4% in 1937-38, the peak of period of examination of 30602 vessels when the numbers breeding fell to 4412 from 5551 in 1935-36 all complying with the procedure.

This working was detailed and published by me in three preliminary papers (Nos. 3, 4, 5) on the subject as referred to at the end of the article. The following figures give the actual working for the last 7 years:—

COUNTRY CRAFT.

<i>Years.</i>	<i>Examined.</i>	<i>Breeding.</i>	<i>Emptied out.</i>	<i>Percentage.</i>
1935.	898	458	358	51 %
1935-36.	19,453	5,608	5,551	28.7 %
1936-37.	22,789	4,338	4,335	19.3 %
1937-38	30,602	4,412	4,412	14.4 %
1938-39.	27,301	3,612	3,612	13.2 %
1939-40.	34,338	2,768	2,768	8.06 %
1940-41.	26,195	1,639	1,639	6.2 %
1941-42.	25,200	1,466	1,466	5.8 %

At the end of 1936, as a result of the voluntary work having been carried out successfully, the Government of Bombay gave the Port Trust compulsory powers by a rule under the Ports Act 1908 section 6 (1) (p) to inspect and deal with country craft so infested within the precincts of the Port and the Trustees appointed their Administrative Medical Officer to carry out the work. Soon after in 1937 a further step was taken in fitting of a mosquito-proof cap with a wooden cork or plug for the open entrances with provision of a separate tap to draw off water. This was at first fitted to our own craft for effectively stopping breeding of *Stegomyia* in the barrels and was adopted as a standard for others to follow when found successful.

The cap is made of a strong perforated zinc plate with a mesh of 1/16 in. in the shape of an inverted square boater fixed to the opening by screws. It is closed by a wooden cork or plug with a nob on top to which a small chain is attached anchoring it to a side of the opening (for full details with sketches and plans see paper 6). Thus the cap serves as a filter to all impurities and does not allow the imago or full-grown insect to escape even if water be laden with eggs of the mosquito. The cork keeps out cotton, cocoanut and other fibres, dust or coal particles entering it, thus keeping the water sweet and clear and further eliminating risk of contamination by hands dipped into the water. A brass cock or tap is fitted at a suitable distance from the bottom of the cask or barrel to draw water which is used mainly for drinking purposes. The capacity of such a barrel is often some 10-25 gallons for a

small and for a big square wooden cistern about 400 or more gallons each carried by country craft coming from long distances like Karachi, Cutch, Kathiawar, Cochin, Arabia, Africa, etc. The whole Western Coast line or littoral of India is infested with this mosquito as shown by craft coming from estuaries and even rivers up the coast such as from Surat, Navsari, Goa and Cochin etc. where water is often taken from wells or step wells.

The gradual diminution in the findings of breeding in subsequent years is an event of evolutionary reduction of the *Stegomyia* Index due to constant inspections and emptying out of such infested craft. The device if and when adopted to those coming from other ports will still reduce the *Stegomyia* Index to the normal safe one of 2%.

I am glad to report that so far the caps and taps fitted by kind permission of the Trustees at their Workshops have withstood more than 4 years of hard wear and tear and none of the barrels so fitted have shown any breeding. The advantages of this pucca device are evident in the long service and efficacy of its working the benefits of which are now being appreciated by all owners who often request and send new barrels to be fitted up at our Workshops. Further no drastic action under the powers has been necessitated nor any obstruction offered by the owners or servants plying the boats. It has freed them of the annoying attention of their own mosquitoes bred in man-made receptacles as said by Mhatre and Covell in their reports.

To deal with this nuisance in the Port, for some two decades, both the Bombay Municipality and Port Trust have approached the Government from time to time, but no decision was arrived at in the absence of a suitable working scheme and when this was attained on sound and practical lines it was easy for Government to give the long-needed powers to the Port Trust to enforce control over the infested craft entering their precincts. Thus in this instance instead of Legislature enforcing a certain procedure or custom, the correct procedure has justified the necessary enactment or rule as a beneficial one. This provision of cap and tap and constant inspections are the full answer to Brig. Covell's quest in 1928 to devise a way to check this nuisance of constant annoyance and danger to the public and the sea faring or Mercantile Community visiting the Harbour. In fact all of Col. Covell's recommendations have been practically carried out during my regime including Roof-gutters work, a pioneer work of its kind in Indian Ports with mosquito-proofing of all Port Trust tanks both on ground and overhead at considerable expense. Lastly larvicidal *Gambusia* fish has been introduced into sweet water static and open tanks. That instead of Bombay being one of the Worst Ports in the East for Mosquitoes, I have tried to make it one of the Safest Ports in the East. For this I have to thank all the Chairmen and Trustees of the Port with the present Chairman, Sir B. Rama Rao, I.C.S., for the kind help and the latter for permission to publish this paper.

BOMBAY,
February 13, 1943.

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XXII.—OBSERVATIONS ON A FEW CASES OF LARVAL ECDYSIS OF THE INDIAN GLOW-WORM, *LAMPROPHORUS TENEBROSUS* WLK.

1. *A complete moult of the larva.*

On 12th March '42, a completely moulted skin was found along with a larva kept in a dish and the newly moulted larva was bright and oily with the marginal areas of the dorsal plates more brownish than yellowish. From an examination of the moult it was discovered that the thin cuticle lining the photogenic organ also was cast and the linings of the tracheal tubes were as usual left attached to the moult here and there. The linings of the mouth-parts and even the eye were cast out. The whole moult was complete excepting a small gap at the ventral portion of the thorax, through which I suppose the animal would have wriggled out.

2. *A case of moulting inside a 'closed burrow'.*

A fairly large larva, measuring about 55 mm. in length was left in a glass tray over moist earth on 1st March 1942. It was supplied regularly with snails, but the glow-worm did not feed. It was unusually very inactive. After 2 or 3 days it began to burrow into the earth and by the 9th a deep burrow was constructed against a side of the tray. The burrow was about 2 inches deep and the hollow inside was lined with a smooth surface. The animal had completely buried itself inside the burrow, which was closed with earth above. Occasionally by disturbing it I could see through the glass a bright glow inside the burrow. On 15th morning I saw the creature with a completely moulted skin attached to it. I took both the larva and its moult out and the larva of the fresh instar began to move about. The plates were very soft and delicate, but dark (dark, because ecdysis must have taken place a few hours earlier). The moulted skin had the usual linings of the tracheal tubes attached to it. These linings I could notice inside the hollow of the burrow only on the 15th. So I presume that the larva moulted on the 15th itself, but the whole skin was cast